

Serial No.: 09/663,021  
Group Art Unit: 2815

### AMENDMENTS TO CLAIMS

Please amend pending claims 1, 7, 13, and 19 as indicated below. A complete listing of all claims in the application is as follows:

- B<sup>1</sup>
1. (currently amended) A semiconductor device, comprising:  
a semiconductor with a dielectric layer formed thereon, wherein said dielectric layer overlays a region on said semiconductor and has a channel opening provided therein;  
a first barrier layer disposed in said dielectric layer lining said channel opening, said first barrier layer of a metallic-barrier material;  
a conductive material ~~disposed recessed~~ in said first barrier layer in said channel opening to form a recessed channel; and  
a second barrier layer disposed in said first barrier layer and over said conductive layer ~~in said channel opening~~, said second barrier layer of a metallic-barrier material, ~~whereby said conductive material is totally enclosed in metallic barrier material.~~
  2. (original) The semiconductor device as claimed in claim 1 wherein said first barrier layer is a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.
  3. (original) The semiconductor device as claimed in claim 1 wherein said second barrier layer is a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.
  4. (original) The semiconductor device as claimed in claim 1 wherein said conductive material is selected from a group comprising copper, aluminum, doped polysilicon, gold, silver, a compound thereof, and a combination thereof.
  5. (original) The semiconductor device as claimed in claim 1 wherein said first and second barrier layers are of the same metallic barrier material.
  6. (original) The semiconductor device as claimed in claim 1 wherein said first and second barrier layers have substantially the same thickness.

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7. (currently amended) A method of manufacturing a semiconductor device, comprising said steps of:

providing a semiconductor with a dielectric layer formed thereon;

forming an opening in said dielectric layer, said opening defined by walls of said dielectric layer;

forming a first barrier layer in said opening and lining said dielectric layer, said first barrier layer is a ~~metallie~~-barrier material;

forming a conductive layer on said first barrier layer in said opening;

removing said conductive layer and said first barrier layer outside said opening down to said dielectric layer;

~~removing a portion of~~recessing said conductive layer inside said first barrier layer ~~said opening to form a recessed channel~~; and

forming a second barrier layer in said first barrier layer and over said conductive layer ~~in said opening~~, said second barrier layer is a ~~metallie~~-barrier material whereby ~~said conductive layer is totally enclosed in metallie barrier material~~.

8. (original) The method for manufacturing a semiconductor device as claimed in claim 7 wherein said step of forming said first barrier layer uses a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.

9. (original) The method for manufacturing a semiconductor device as claimed in claim 7 wherein said step of forming said second barrier layer uses a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.

10. (original) The method for manufacturing a semiconductor device as claimed in claim 7 wherein said step of forming said conductive material uses a material selected from a group comprising copper, aluminum, doped polysilicon, gold, silver, a compound thereof, and a combination thereof.

11. (original) The method for manufacturing a semiconductor device as claimed in claim 7 wherein said step of forming said first and second barrier layers use the same metallic barrier material.

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12. (original) The method for manufacturing a semiconductor device as claimed in claim 7 wherein said step of forming said first and second barrier layers for said first and second barrier layers to substantially the same thickness.

13. (currently amended) A method of manufacturing a semiconductor device, comprising said steps of:

providing a semiconductor wafer with a dielectric layer formed thereon;

forming an opening in said dielectric layer, said opening defined by walls of said dielectric layer;

depositing a first barrier layer on said semiconductor wafer and in said opening to line

said dielectric layer, said first barrier layer is a metallic barrier material;

depositing a conductive layer on said first barrier layer on said semiconductor wafer

and in said opening, said conductive layer filling said opening;

removing said conductive layer and said first barrier layer on said semiconductor wafer outside said opening down to said dielectric layer;

~~removing a portion of recessing~~ said conductive layer inside said first barrier layer said opening to a predetermined depth to form a recessed channel;

depositing a second barrier layer over said semiconductor wafer and said ~~conductive~~

layer recessed channel in said ~~opening~~ first barrier layer to fill said opening

first barrier layer to about said predetermined depth, said second barrier layer is a metallic barrier material; and

removing said second barrier layer on said semiconductor wafer outside said opening

~~down~~ first barrier layer to said dielectric layer ~~whereby said conductive layer is totally enclosed in metallic barrier material.~~

14. (original) The method for manufacturing a semiconductor device as claimed in claim 13 wherein said step of depositing said first barrier layer uses a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.

15. (original) The method for manufacturing a semiconductor device as claimed in claim 13 wherein said step of depositing said second barrier layer uses a metallic barrier material selected from a group comprising tantalum, titanium, tungsten, a compound thereof, and a combination thereof.

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16. (original) The method for manufacturing a semiconductor device as claimed in claim 13 wherein said step of depositing said conductive material uses a material selected from a group comprising copper, aluminum, doped polysilicon, gold, silver, a compound thereof, and a combination thereof.

17. (original) The method for manufacturing a semiconductor device as claimed in claim 13 wherein said step of depositing said first and second barrier layers use the same metallic barrier material.

18. (original) The method for manufacturing a semiconductor device as claimed in claim 13 wherein said step of removing said conductive layer to a predetermined depth removes said first barrier to the same depth as the thickness that said first barrier layer is deposited.

19. (currently amended) A semiconductor device, comprising:  
a semiconductor;  
a dielectric layer formed on the semiconductor, said dielectric layer having a channel opening provided therein;  
a recessed channel in said channel opening including:  
a first barrier layer disposed in said channel opening, said first barrier layer of a metallic barrier material; and  
a conductive material disposed recessed in said first barrier layer, and  
a self-aligned semiconductor interconnect barrier disposed in said first barrier layer and over said recessed channel conductive material in said channel opening.

20. (currently amended) The semiconductor device as claimed in claim 19 wherein said first barrier layer and said self-aligned ~~semiconductor interconnect barrier~~ totally enclose the conductive material.